THE LIFE-WORK OF AN EMINENT METEOROLOGIST.

Gesammelte Abhandlungen aus den Gebieten der Meteorologie und des Erdmagnetismus. Von Wilhelm von Bezold in Gemeinschaft mit A. Coym. Herausgegeben vom Verfasser. Pp. viii+448; illustrated. (Brunswick: F. Vieweg and Son, 1906.) Price 14 marks.

PROF. VON BEZOLD'S position as the late head of the Prussian Meteorological Institute suffices to make the publication of his collected works on meteorology and terrestrial magnetism an event of importance. His papers on electricity and physiological optics remain apparently to be dealt with. In preparing the present work for press, he had the assistance of Dr. Coym, formerly of the Meteorological Institute. The collection includes twenty papers; in some, slight alterations have been introduced and some notes have been added.

Only the earliest paper, written in 1864, represents von Bezold as himself an observer. It treats of the phenomena visible after sunset, especially of what von Bezold terms the "Purpurlicht." An appendix refers to recent authorities, and especially to the effect of volcanic ejecta on the richness of the phenomena.

The next three papers deal with the frequency of thunderstorms. It is explained in an appendix, pp. 83–90, that much of von Bezold's writings on this subject seemed of too local interest to reproduce. In the first paper, after dealing with statistics from a number of stations—mostly in central Europe—von Bezold decides in favour of a connection between thunderstorm and sun-spot frequency. His conclusion on p. 59, repeated in the last thunderstorm paper, p. 82, is that thunderstorm and auroral frequency follow opposite courses, thunderstorms being least frequent in years of sun-spot maximum, when auroras are most numerous. This conclusion must be regarded with some reserve.

In the next paper, dealing with sun-spot data from Bavaria and Württemberg, von Bezold considers the evidence favourable to the reality of a twenty-six-day period in thunderstorms. A footnote dated 1905 qualifies this, pointing out that it would be natural to look for the source of a twenty-six-day period in the sun, and as it is probable that the seat of greatest activity in the sun changes its position, the twenty-six-day period will naturally change its phase, and so be recognisable only in statistics covering a comparatively short period. This seems the same position as has been taken up in the case of magnetic storms by Maunder, who, however, finds a period of about 27¼ days. The reality of a period the phase of which alters in an indefinite way is rather a difficult matter to decide.

The third of the thunderstorm papers suggests an extraordinary increase in damage by lightning in Germany. In Bavaria the percentage of (insured) houses struck by lightning was fully six times as great in the decade 1893–1902 as in the decade 1833–1842. Von Bezold appears to accept the increase as proved all over Germany. Other German authorities, it may be added, have expressed some doubts as to the true significance of the insurance statistics; the phenomena may not be purely meteorological.

Papers v.–ix., pp. 91–220, form a group devoted to the thermodynamics of the atmosphere. The elementary portion of air contains moisture which may be wholly gaseous, or partly condensed in raindrops, in snow, or in hail. Also the air element resembles a compartment of a train in that its original occupants may leave it at intermediate stations, whilst new occupants may come in. Change of state in the water contents implies evolution or absorption of heat, and the five papers aim at tracing the various possible modifications and identifying them with the phenomena of cyclones, anticyclones, Föhn winds, and so on. The reader to whom German presents difficulties will find an English translation of the first three papers of the group in Prof. Cleveland Abbe's "The Mechanics of the Earth's Atmosphere"; he must, however, be on his guard against misprints. The present reprint contains some fresh notes, and shows some alterations, *e.g.* on pp. 123 and 125, dealing with cyclonic and anticyclonic phenomena. These thermodynamical papers represent a product which the typical English meteorologist will contentedly deny himself. If, however, the Cambridge mathematical meteorologist ever comes into being, he ought to read these papers as part of his preliminary education. If he reads them critically in the light of recent meteorological knowledge he will—whether he agrees wholly with the author or not—have done a good deal to qualify himself for profitable research in the dynamics of the atmosphere.

Papers x.–xv. are also in the main theoretical, but they contain information from balloon ascents as to temperature and moisture in cyclonic and anticyclonic weather at different seasons of the year. Paper xvi. gives statistics from various sources as to the mean annual values of temperature, pressure, rainfall, and cloud round parallels of the earth. To obtain zones of equal area, the author takes as parameter the *sine* of the latitude. This paper leads naturally to xvii., the first of four papers, pp. 371–448, devoted to terrestrial magnetism, in which von Bezold considers what he calls the "isanomalies" of the magnetic potential, *i.e.* the departures from the mean value round a parallel of latitude. Paper xviii. deals with what the author calls the *normal* earth's magnetism. Paper xix. treats of the foundations of the Gaussian theory as based on the vanishing of line integrals taken round areas on the earth's surface, and discusses the diurnal variation, in the light of Prof. Schuster's variation potential, and its representation by vector diagrams.

The final paper advocates the taking of magnetic observations round a parallel of latitude, which von Bezold suggests might pass through the south of England. To a magnetician familiar with the Gaussian analysis and with Schuster's work on the diurnal variation, von Bezold's contributions to the subject will appear to be rather a matter of definitions and identifications than of original ideas. To those, however, who have a difficulty in grasping the physical significance of abstruse mathematics, they may serve a useful purpose, provided it be clearly

understood that anything like a complete treatment of the diurnal variation requires a careful study of the influence of the season of the year as well as the relation to sun-spot frequency. The proposal advocated by von Bezold and others to effect a line integration round a parallel of latitude ought before its adoption to receive careful consideration from the side of atmospheric electricity. It should be remembered that the earth-air currents required to invalidate the hypothesis embodied in the Gaussian potential are not transient currents varying with the hour of the day or with the weather—such currents could only modify the magnetic diurnal inequality or cause irregular disturbances—but currents of practically constant value and direction over large areas.

Since the above was written, science has had to mourn the death of the distinguished author, Prof. von Bezold, a fact already announced to the readers of NATURE (February 21, p. 397).

CHARLES CHREE.

THE COLLOIDAL THEORY OF DYEING.

The Chemistry and Physics of Dyeing. By W. P. Dreaper. Pp. viii + 315; illustrated. (London: J. and A. Churchill, 1906.) Price 10*s.* 6*d.* net.

WHEN it is remembered that dyeing has become a highly scientific process, it is somewhat strange to note what a small part theoretical considerations have played in the practical development of the art, a fact no doubt largely due to the lack of definite knowledge of the chemical constitution of textile fibres. Most manuals of dyeing have been written for practical ends, and have devoted small space to the consideration of the various theories of dyeing which have been put forward, since, as before remarked, these have helped but little in the practical solution of dye-house problems. Our knowledge of the nature of fibres has, however, now reached a point when it is undoubtedly of value that the scientific dyer should make himself acquainted with this side of his subject, and recent work on the nature and properties of colloids certainly appears to throw much new light on the intricate nature of dyeing processes.

It has, of course, long been known that one and the same kind of fibre acts differently towards various dyes, and that dyestuffs may be classified into groups on the basis of this differentiation. To a considerable extent this grouping is found to correspond with fundamental similarities in the chemical constitution of the dyes, and this broad fact has lent strong support to the chemical theory of dyeing.

The older theories of dyeing could be broadly classified into two groups, those assuming a chemical reaction between fibre and dye, and those in which dyeing phenomena are explained by the physical properties of the reacting bodies. To a great extent these theories are antagonistic, and yet upholders of each are able to put forward incontrovertible facts in their support. It is, however, far from satisfactory to have to assume that similar phenomena can be explained in one case by a certain theory and in a second by an opposite theory, and the time is ripe for a wider view which shall embrace and reconcile all well-established facts concerned with dyeing processes. How far the colloidal theory of dyeing is successful in doing this may be gathered from a perusal of the book under review. Much of the experimental work mentioned lacks precision, and the various researches are somewhat detached, but the present knowledge of colloidal conditions and functions, incomplete as it is, throws much light on earlier work, and from further work in this direction a satisfactory explanation of dyeing processes may eventually emerge. In the past many difficulties, in regard to dyeing theory as in other directions, have arisen from an attempt to draw a hard and fast line between chemical and physical action, and the blending of the two may be considered as the characteristic feature of the reactions of colloids.

The book is arranged in twelve chapters, of which the first is devoted to a historical introduction, which might with advantage have been considerably extended. The properties and reactions of fibres, dyes, mordants, and assistants are dealt with in chapters ii.–v. Chapter vi. contains an excellent summary of the recent work on the properties of colloids. Chapter vii. gives facts in support of the old mechanical theory of dyeing which reached its final development in the solid solution theory of van 't Hoff and Arrhenius, which was applied to dyeing processes by O. N. Witt. Chapters viii. and ix. give a similar summary of facts supporting the chemical theory of dyeing. Then follows in chapter x. an attempt to show the application of the colloidal theory, and in this the incompleteness of the evidence becomes apparent, though as a suggestive contribution it is very interesting. A chapter on the action of light on dyeing operations and dyed fabrics appears to have little connection with the central theme of the work.

The many inaccuracies in the book lay it open to a good deal of minor criticism. For example, on p. 14 several of the formulæ are altogether inexplicable. On p. 33 it is stated that Bancroft divided dyes into *subjective* and adjective, the term used by Bancroft being *substantive*. A fair summary of the work of various investigators is usually given in the text, but it is often difficult to ascertain at what point the summary ends and the author's comments begin. There is thus some danger of injustice to one or other. Since both centigrade and Fahrenheit thermometric scales are used in the book, some confusion arises in the frequent cases where a temperature figure is given without indicating which scale it refers to. Amongst mis-spelt authors' names may be mentioned Verquin for Verguin, Pokorng for Pokorny (several times), Prager for Perger, Brand for Brandt, Boettinger for Böttiger, and Hirst for Hurst.

The general plan of the book is excellent, and the author's work, though somewhat unequal, is on the whole very satisfactory. The production of such a book would have been impossible a few years ago, and it marks a distinct advance in the linking up of one of the most ancient arts with modern scientific